# DINOSAURS!

•DISCOVER THE GIANTS OF THE PREHISTORIC WORLD•

## 102

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# DINOSAURS!

**• DISCOVER THE GIANTS OF THE PREHISTORIC WORLD •**

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# GILMOREOSAURUS

***Gilmoreosaurus* may be a missing link between two dinosaur groups.**

The discovery of *Gilmoreosaurus* in 1923 excited dinosaur experts. They realised they had found one of the earliest hadrosaurs.

**TWO KINDS**

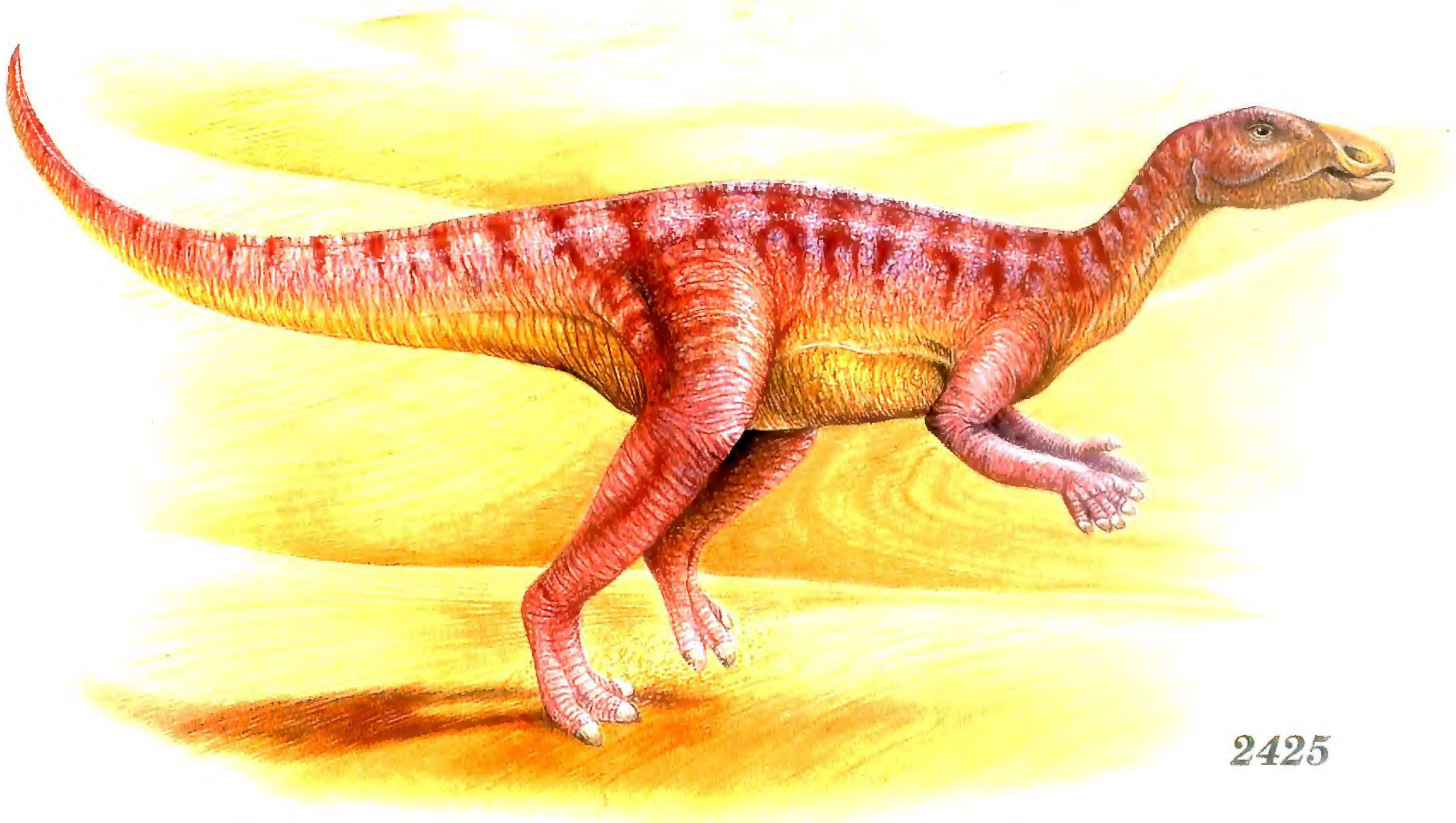
Hadrosaurs lived in the Late Cretaceous. They were one of the most important and successful groups of plant-eating dinosaurs. Hadrosaurs were divided into two families – the hadrosaurids (duckbills) and the lambeosaurids. The hadrosaurids, such as *Gilmoreosaurus*, had longer lower jaws and longer legs and did not have the lambeosaurids' hollow crests.

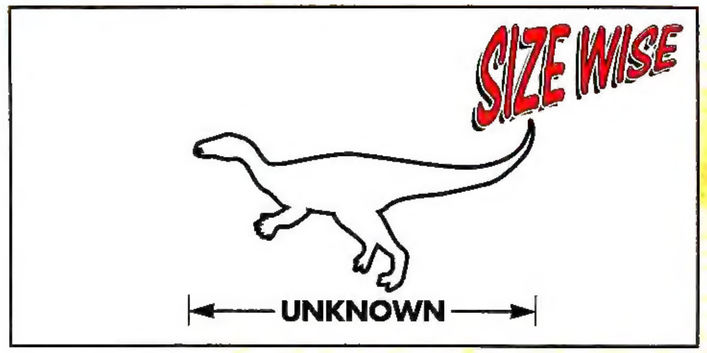
**FAR AND WIDE**

*Gilmoreosaurus* was an early hadrosaurid. Its remains were found in Mongolia. By the end of the Age of the Dinosaurs, however, the hadrosaurids had spread across the world. Their fossils have been found in North and South America, Europe and Asia.

**MISSING LINK**

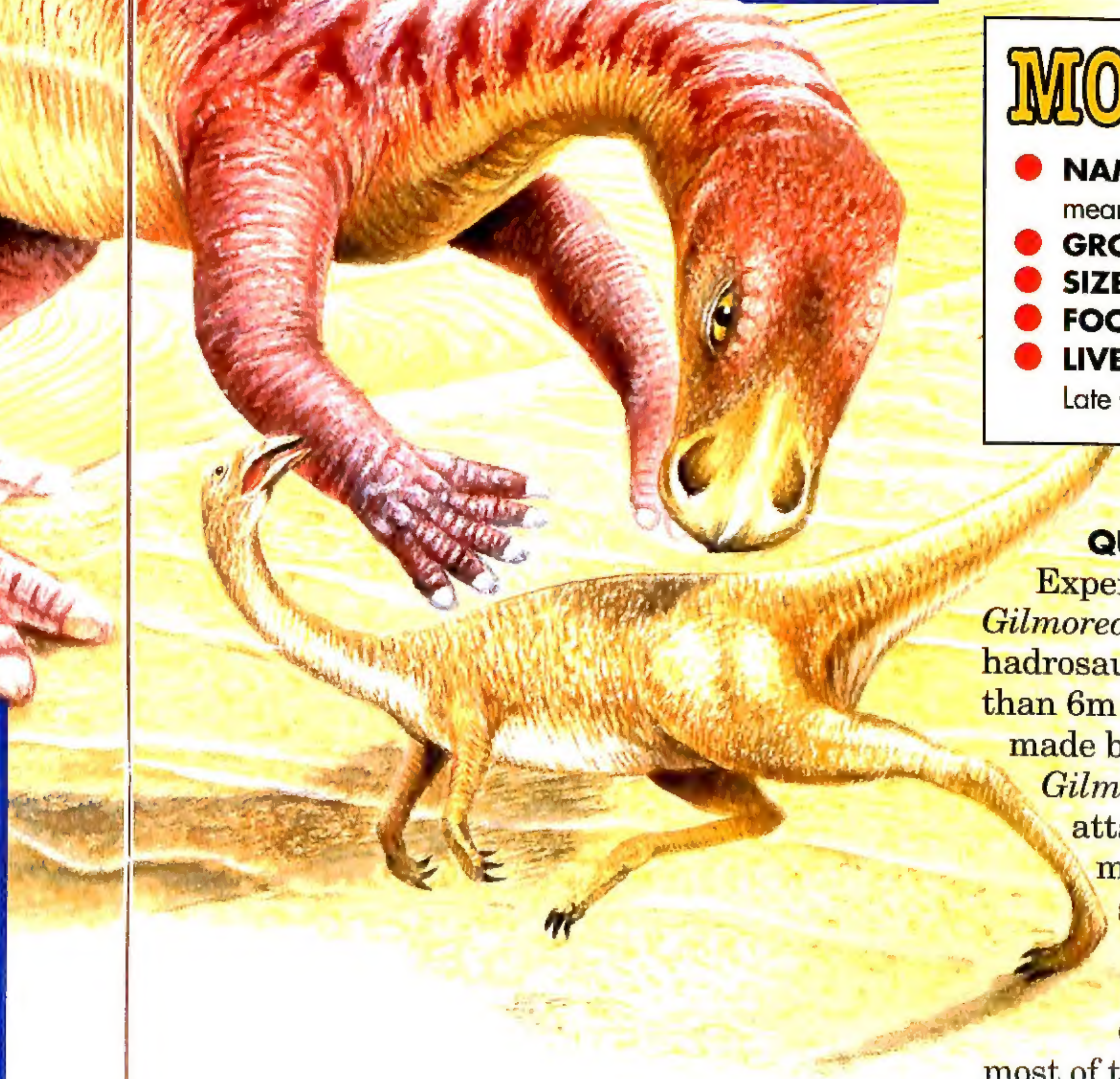
Experts were interested to find that *Gilmoreosaurus* resembled members of an earlier group of plant-eaters. Its claw-like toes looked more like those of an iguanodontid, such as *Iguanodon*, than a hadrosaurid. Scientists think *Gilmoreosaurus* may have been the link between these two groups. It could mean that hadrosaurids evolved from iguanodontids.





## END OF AN ERA

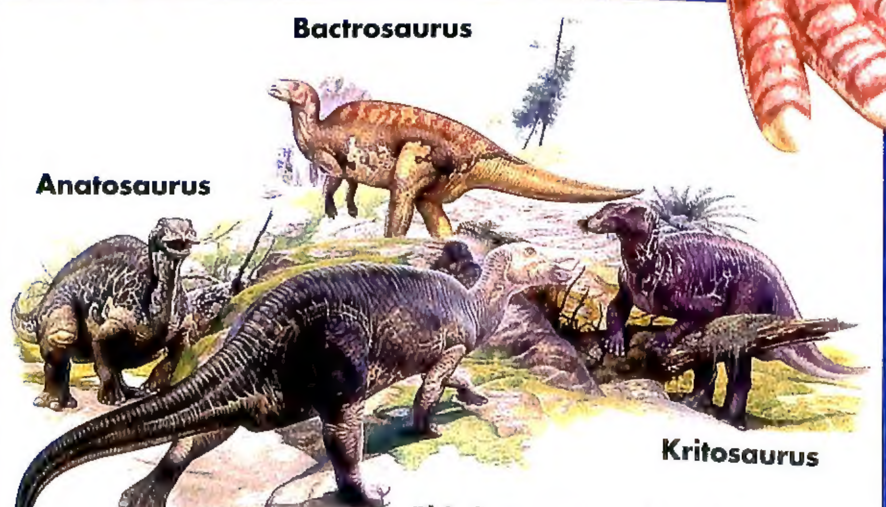
The iguanodontids were a successful group of plant-eating dinosaurs that died out in the Late Cretaceous, at the same time that the hadrosaurs appeared. Experts believe that the iguanodontids may have disappeared because they could not compete with the hadrosaurs for food. The iguanodontids were not as efficient at feeding as the lambeosaurids and the hadrosaurids.



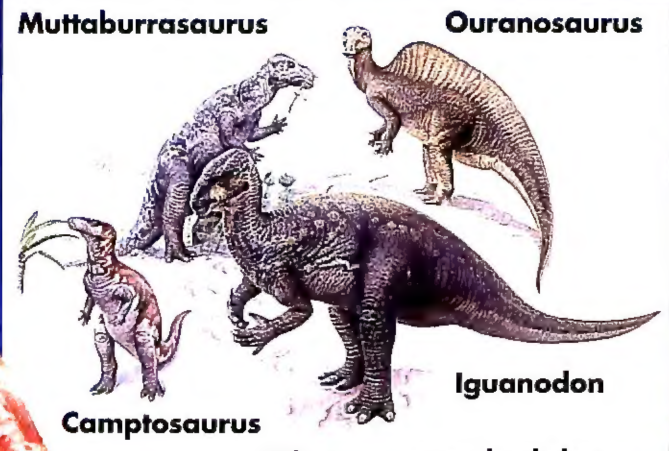
***Gilmoreosaurus* was a powerfully built plant-eater. It would have been able to chase off an egg-stealer such as little *Gallimimus* by lashing out with its clawed front feet.**

## ODD ONE OUT

Only a few scattered bones of *Gilmoreosaurus* have been found. However, these remains were enough to convince experts that this dinosaur must have been a primitive hadrosaurid. This was despite the fact that *Gilmoreosaurus* looked different from most other members of this family. Other hadrosaurids had more hoof-like feet. They also had less powerful limbs.



**This is a group of hadrosaurids. *Gilmoreosaurus* was an early member of this family.**



***Gilmoreosaurus* had claw-like toes resembling those of these Iguanodontids**

## IT'S A FACT

### NEW FOR OLD

Hadrosaurs had an important advantage over other plant-eating dinosaurs. They grew new teeth to replace teeth that were worn down. This made them extra-efficient feeders.

## MONSTER FACTS

- **NAME:** *Gilmoreosaurus* (gil-more-oh-saw-rus) means 'Gilmore's lizard'
- **GROUP:** dinosaur
- **SIZE:** unknown
- **FOOD:** plants
- **LIVED:** about 80 – 85 million years ago in the Late Cretaceous Period in Mongolia

## QUICK START

Experts do not know the size of *Gilmoreosaurus*, but it was small for a hadrosaur and probably measured less than 6m long. It was more powerfully made but lighter than most hadrosaurs. *Gilmoreosaurus* had large muscle attachments to its hind legs, so it may have been able to make a speedy getaway if attacked.

## IT'S A GRIND

*Gilmoreosaurus* must have spent most of the day browsing for food on all fours. It would have nipped off plants with its beak, then ground them up between rows of tightly packed back teeth.

# CACOPS

***Cacops* was a small, armoured amphibian that was more at home on land than in the water.**

**C***acops* lived during the Early Permian. At that time, about 300 million years ago, the Earth's climate was changing dramatically. The warm, steamy weather at the end of the Carboniferous gave way to the dry, arid climate of the Permian.

### ADAPT OR DIE

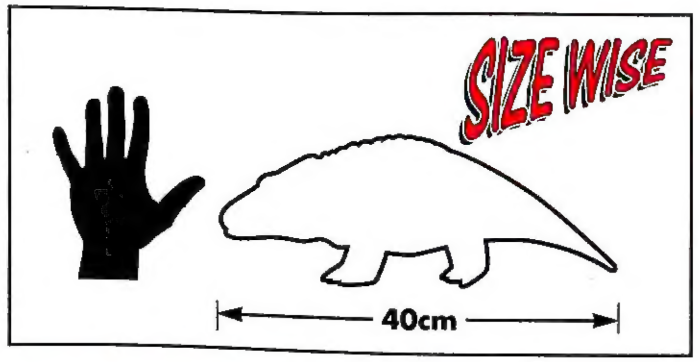
Amphibians, such as *Cacops* and its close relative *Platyhystrix*, adapted quickly to the changes. Experts believe that *Cacops* was better adapted to life on land than any other amphibian. It had a stocky body, a wide mouth for swallowing prey, and the same strong legs as a land-living reptile.

### ARMOURED AMPHIBIAN

The reptiles flourished in the Early Permian. They would have preyed on the land-living amphibians. *Cacops* had bony plates covering its body for protection. It also had a row of thick armour running down its backbone.

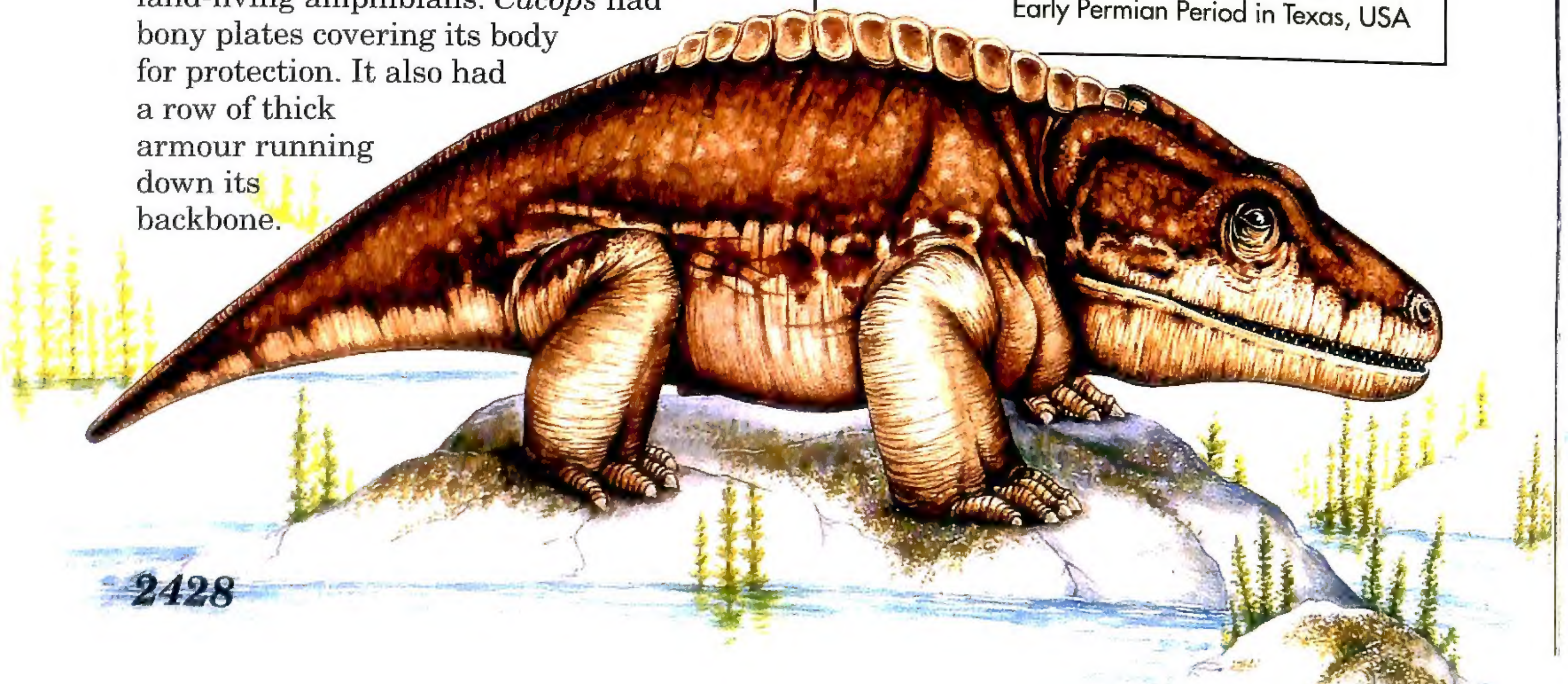
### HOLES FOR HEARING

*Cacops* had very strange 'ears'. It had a wide opening behind each eye. This was covered by a piece of very thin skin, called a membrane, which acted like an eardrum to hear sounds carried on the air.



## MONSTER FACTS

- **NAME:** *Cacops* (kay-kops) means 'looking like a blind man'
- **GROUP:** amphibian
- **SIZE:** 40cm long
- **FOOD:** meat
- **LIVED:** about 300 million years ago in the Early Permian Period in Texas, USA



# NEUQUENSAURUS

**Massive *Neuquensaurus* was a sauropod protected by hard, bony body armour.**

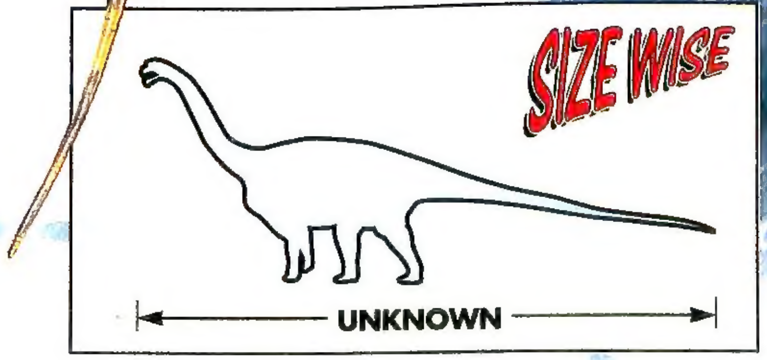
**T**he discovery that *Neuquensaurus* had body armour was very important. Some experts thought that it helped prove that all the other dinosaurs that belonged to the same plant-eating family had heavily protected backs, too.

### LEGENDARY GIANTS

*Neuquensaurus* was a member of the titanosaurid family. They were named after the giants called titans in Greek legend. These sauropods were all heavy and huge. They did not have the same hollowed out backbones later sauropods had. Some titanosaurids survived to the end of the Age of the Dinosaurs.

### COVER UP

*Neuquensaurus* was not like most other sauropods. They simply had tough skin, but *Neuquensaurus* had really thick body armour.



## MONSTER FACTS

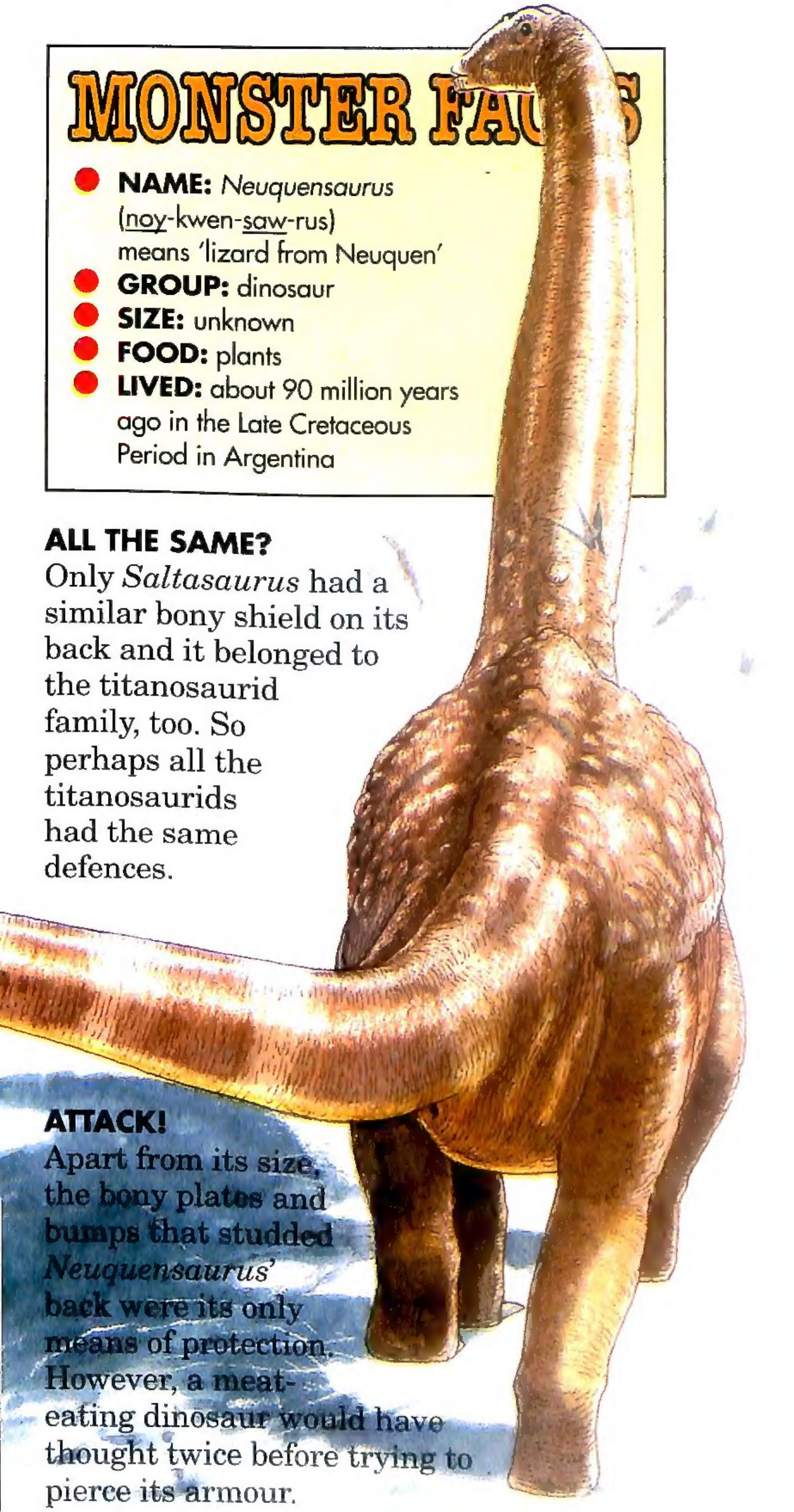
- **NAME:** *Neuquensaurus* (noy-kwen-saw-rus) means 'lizard from Neuquen'
- **GROUP:** dinosaur
- **SIZE:** unknown
- **FOOD:** plants
- **LIVED:** about 90 million years ago in the Late Cretaceous Period in Argentina

### ALL THE SAME?

Only *Saltasaurus* had a similar bony shield on its back and it belonged to the titanosaurid family, too. So perhaps all the titanosaurids had the same defences.

### ATTACK!

Apart from its size, the bony plates and bumps that studded *Neuquensaurus*' back were its only means of protection. However, a meat-eating dinosaur would have thought twice before trying to pierce its armour.



# DINOSAUR SAFARI

# LATE CRETACEOUS ALBERTA

**Let's walk through the mountains of Alberta, Canada. The scenery is beautiful, but watch out! It is the Late Cretaceous and you are wandering through dinosaur country.**

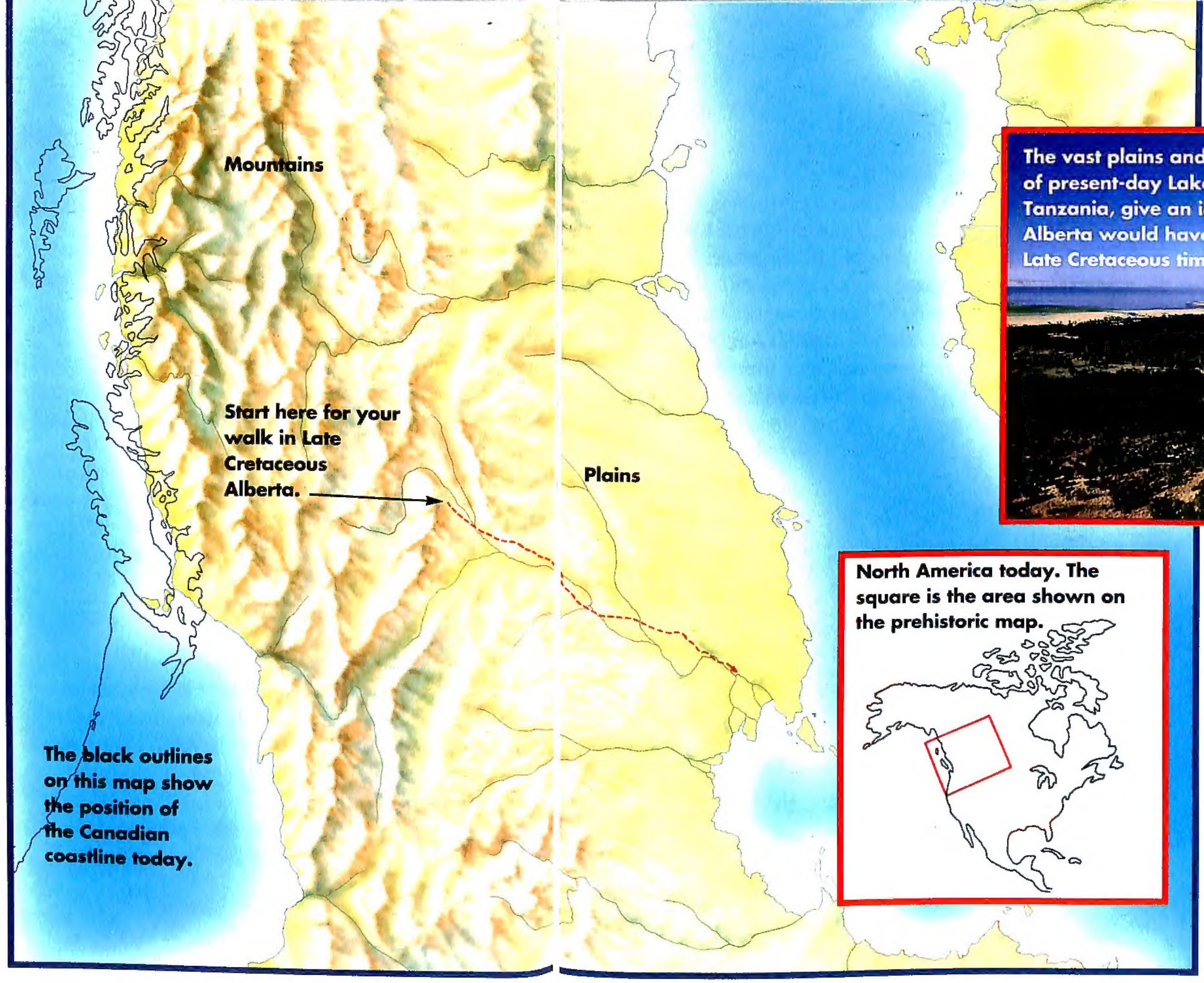
You are standing on a breezy hillside. Mountains tower to the west and broad plains stretch to the east. Alpine flowers spread out before you. The sound of birdsong echoes everywhere around. This is Late Cretaceous Canada, about 75 million years ago, and you are on a dinosaur safari.

### SKY SURPRISE

At first, the landscape seems too like today's for dinosaurs to be about. Then you notice that the wheeling shapes in the sky you thought were birds are actually pterosaurs. Birds are singing in the bushes, but those flying creatures are definitely reptiles.

### THE HILLS ARE ALIVE

Above the birdsong you hear a strange sound – a 'klunk' like two bricks being bashed together. It is coming from the other side of a group of pine trees. You make your way carefully towards it.



Start here for your walk in Late Cretaceous Alberta.

The black outlines on this map show the position of the Canadian coastline today.

North America today. The square is the area shown on the prehistoric map.

### BONE HEADS

A group of female dinosaurs and their young is resting on the ground. You can tell they are plant-eaters by their big bellies and cheek pouches. Their bony head domes confirm they are *Stegoceras*.

### HEAD-BANGING

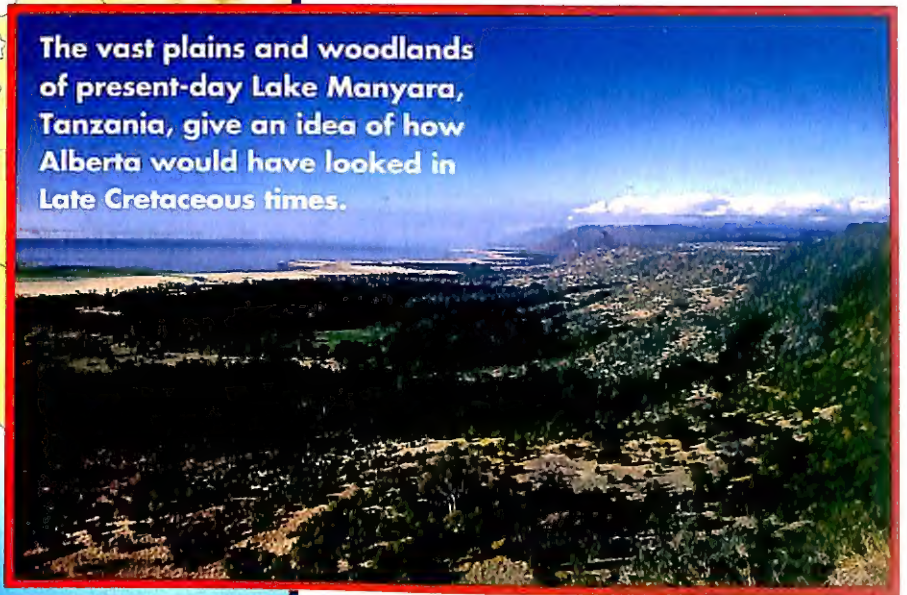
In front of them, two males are fighting to decide who will lead the herd. They stand a few metres apart, lower their battering-ram heads, and charge. Klunk! Soon one slinks away. The other is the new leader.

### WHERE NOW?

Now you climb down to explore the plain, following the path of the mountain streams. The plain stretches eastwards. It is very dry here, sheltered from wet winds by the mountains behind you.

### DINOSAUR DUST

A huge column of dust hangs in the sky to the south. You ignore it and follow the streams. Soon the dust cloud is closer, and there is a rumbling sound. A herd of dinosaurs is on the march – towards you!



The vast plains and woodlands of present-day Lake Manyara, Tanzania, give an idea of how Alberta would have looked in Late Cretaceous times.

### AN UNSTOPPABLE HERD

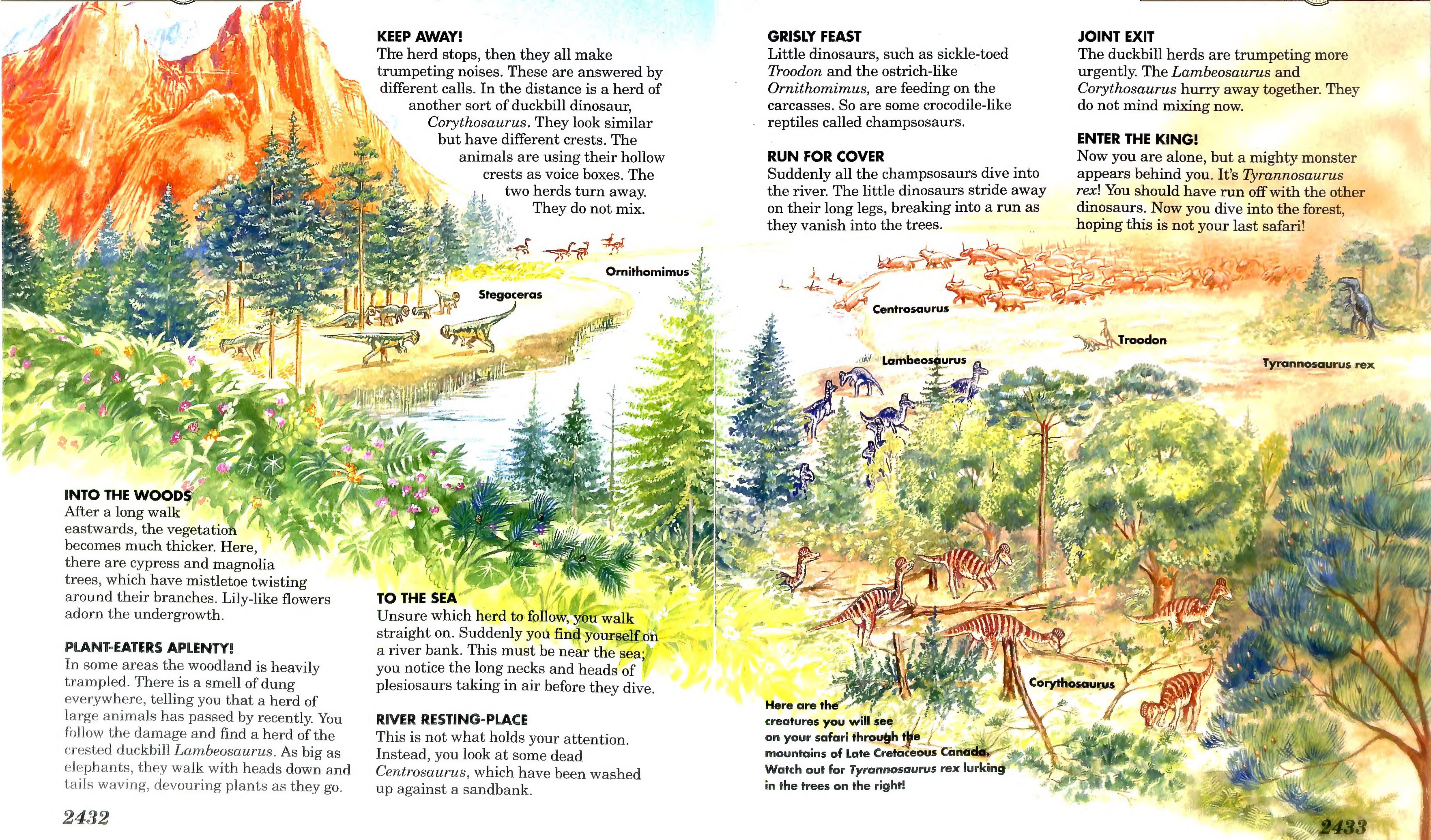
You cannot flee by crossing the river. It is over 50m wide and too deep to wade. You must run along the bank to get away before the herd arrives. You can just see the animals in front now, the rest are hidden in dust. They are the horned dinosaurs *Centrosaurus*. There must be thousands of them!

### LUCKY ESCAPE

You seem to have made your get-away just in time. The leaders of the *Centrosaurus* herd reach the river and you hear them splash in noisily behind you. Then more and more dinosaurs fling themselves into the water, trying to cross it. You turn round to watch this amazing sight.

### MASS TRAGEDY

The water becomes a seething mass of dinosaurs. Some are able to reach the other bank safely, but others lose their footing. They are washed away to their deaths by the powerful current. Many are drowned. There is nothing you can do to help. Instead you turn and make your way downstream in search of new adventures.



**Here are the creatures you will see on your safari through the mountains of Late Cretaceous Canada. Watch out for *Tyrannosaurus rex* lurking in the trees on the right!**

### INTO THE WOODS

After a long walk eastwards, the vegetation becomes much thicker. Here, there are cypress and magnolia trees, which have mistletoe twisting around their branches. Lily-like flowers adorn the undergrowth.

### PLANT-EATERS APLENTY!

In some areas the woodland is heavily trampled. There is a smell of dung everywhere, telling you that a herd of large animals has passed by recently. You follow the damage and find a herd of the crested duckbill *Lambeosaurus*. As big as elephants, they walk with heads down and tails waving, devouring plants as they go.

### KEEP AWAY!

The herd stops, then they all make trumpeting noises. These are answered by different calls. In the distance is a herd of another sort of duckbill dinosaur, *Corythosaurus*. They look similar but have different crests. The animals are using their hollow crests as voice boxes. The two herds turn away. They do not mix.

### TO THE SEA

Unsure which herd to follow, you walk straight on. Suddenly you find yourself on a river bank. This must be near the sea; you notice the long necks and heads of plesiosaurs taking in air before they dive.

### RIVER RESTING-PLACE

This is not what holds your attention. Instead, you look at some dead *Centrosaurus*, which have been washed up against a sandbank.

### GRISLY FEAST

Little dinosaurs, such as sickle-toed *Troodon* and the ostrich-like *Ornithomimus*, are feeding on the carcasses. So are some crocodile-like reptiles called champsosaurs.

### RUN FOR COVER

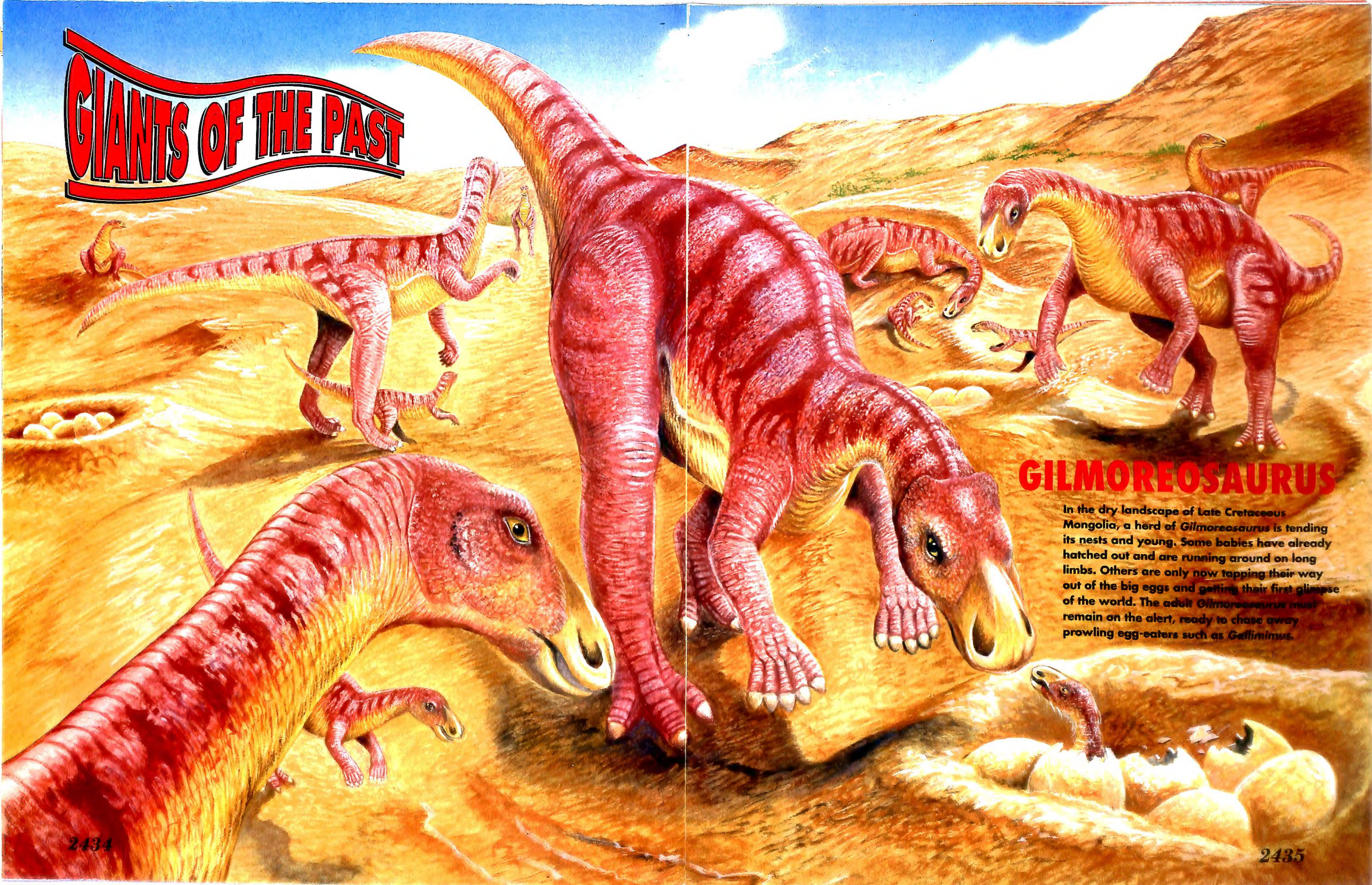
Suddenly all the champsosaurs dive into the river. The little dinosaurs stride away on their long legs, breaking into a run as they vanish into the trees.

### JOINT EXIT

The duckbill herds are trumpeting more urgently. The *Lambeosaurus* and *Corythosaurus* hurry away together. They do not mind mixing now.

### ENTER THE KING!

Now you are alone, but a mighty monster appears behind you. It's *Tyrannosaurus rex*! You should have run off with the other dinosaurs. Now you dive into the forest, hoping this is not your last safari!



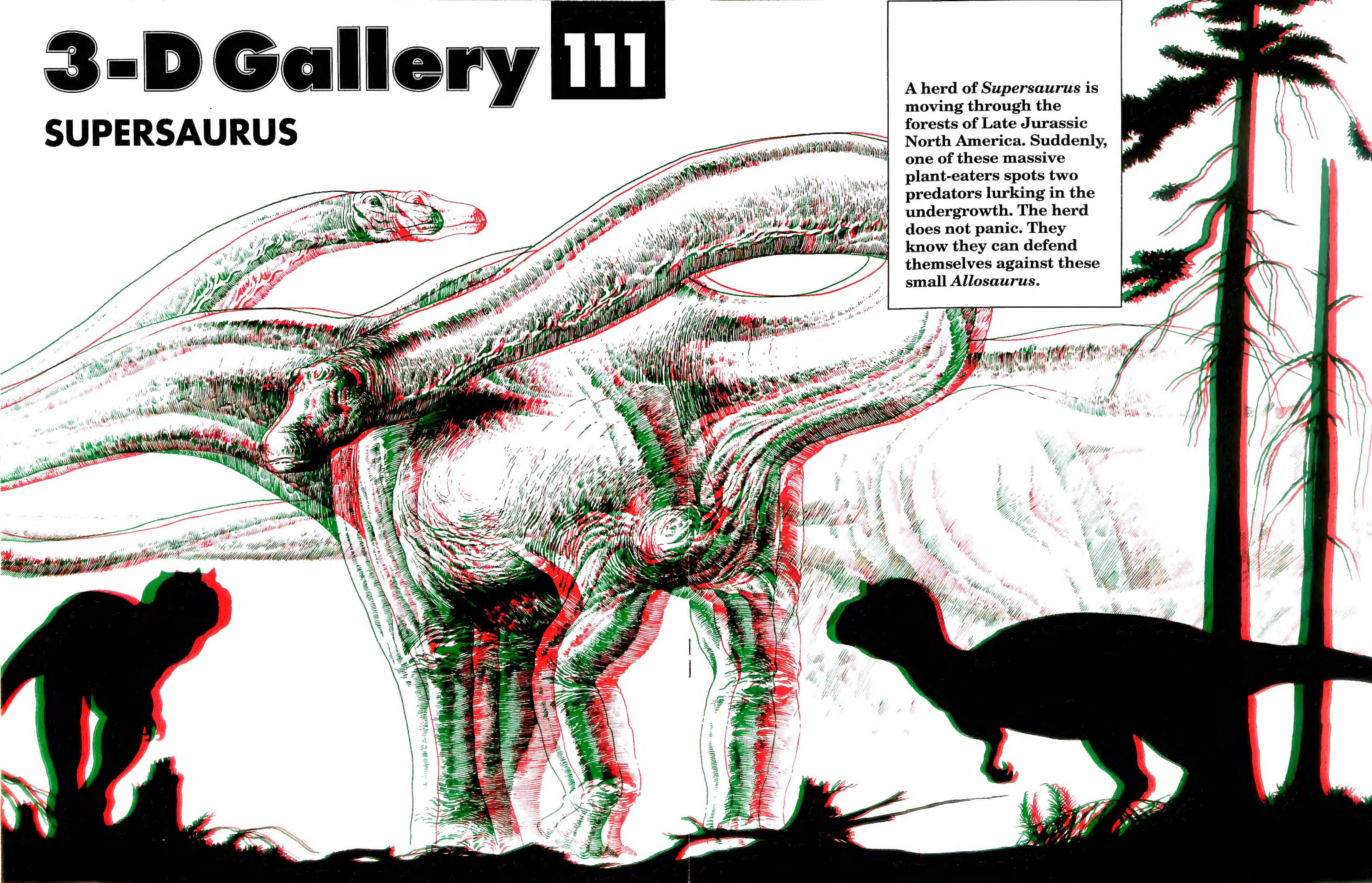
# GILMOREOSAURUS

In the dry landscape of Late Cretaceous Mongolia, a herd of *Gilmoreosaurus* is tending its nests and young. Some babies have already hatched out and are running around on long limbs. Others are only now tapping their way out of the big eggs and getting their first glimpse of the world. The adult *Gilmoreosaurus* must remain on the alert, ready to chase away prowling egg-eaters such as *Gallimimus*.

# 3-D Gallery 111

## SUPERSAURUS

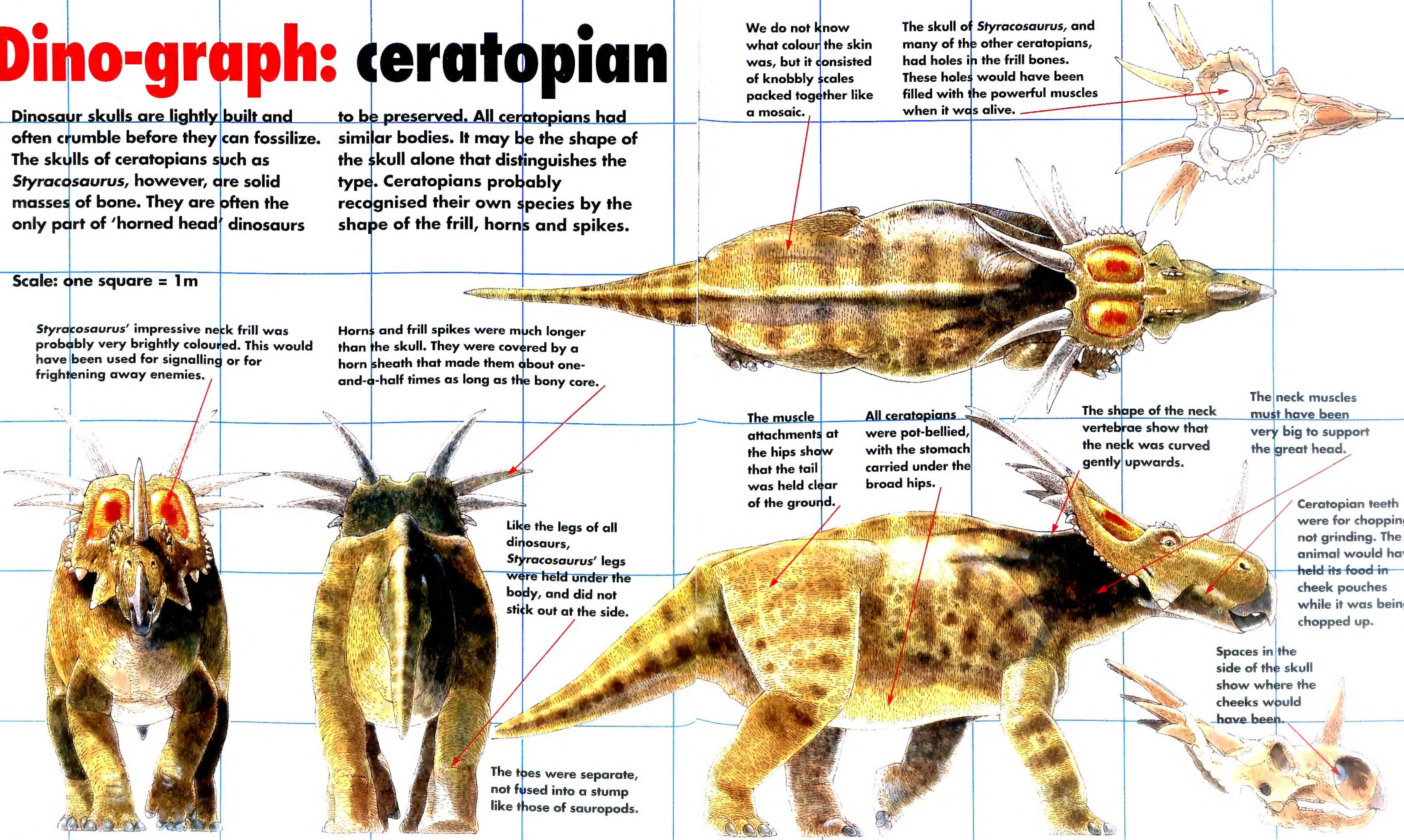
A herd of *Supersaurus* is moving through the forests of Late Jurassic North America. Suddenly, one of these massive plant-eaters spots two predators lurking in the undergrowth. The herd does not panic. They know they can defend themselves against these small *Allosaurus*.



# Dino-graph: ceratopian

Dinosaur skulls are lightly built and often crumble before they can fossilize. The skulls of ceratopians such as *Styracosaurus*, however, are solid masses of bone. They are often the only part of 'horned head' dinosaurs to be preserved. All ceratopians had similar bodies. It may be the shape of the skull alone that distinguishes the type. Ceratopians probably recognised their own species by the shape of the frill, horns and spikes.

Scale: one square = 1m



*Styracosaurus*' impressive neck frill was probably very brightly coloured. This would have been used for signalling or for frightening away enemies.

Horns and frill spikes were much longer than the skull. They were covered by a horn sheath that made them about one-and-a-half times as long as the bony core.

Like the legs of all dinosaurs, *Styracosaurus*' legs were held under the body, and did not stick out at the side.

The toes were separate, not fused into a stump like those of sauropods.

We do not know what colour the skin was, but it consisted of knobbly scales packed together like a mosaic.

The skull of *Styracosaurus*, and many of the other ceratopians, had holes in the frill bones. These holes would have been filled with the powerful muscles when it was alive.

The muscle attachments at the hips show that the tail was held clear of the ground.

All ceratopians were pot-bellied, with the stomach carried under the broad hips.

The shape of the neck vertebrae show that the neck was curved gently upwards.

The neck muscles must have been very big to support the great head.

Ceratopian teeth were for chopping, not grinding. The animal would have held its food in cheek pouches while it was being chopped up.

Spaces in the side of the skull show where the cheeks would have been.

# The first dinosaur discoveries

**People did not know what sort of animals they had found when the first dinosaur fossils were uncovered.**

Oxford museum keeper Robert Plot discovered a piece of fossilized bone in 1677. It was huge, but Plot had no idea what it was. We now know that it must have been a *Megalosaurus*' thigh bone.

### IT'S A REPTILE

It was not until the 1820s, when Gideon Mantell and his wife Mary started finding pieces of *Iguanodon* in England, that the study of dinosaurs really began. They only found teeth and a few bones, but Mantell realised that he was looking at the remains of a giant plant-eating reptile.

### THE FIRST TO BE NAMED

Meanwhile, in 1824, back in Oxford, William Buckland found the jawbone and teeth of something big and carnivorous. He also realised that he had found a huge reptile. He called it *Megalosaurus*.

### COINING A FAMOUS NAME

The name 'dinosaur' was not used until 1841. Richard Owen, addressing a meeting of the Royal Society for the Advancement of Science in Plymouth, proposed the name 'dinosauria' to cover these newly discovered animals. The term included *Iguanodon* and *Megalosaurus*, as well as another of Mantell's finds, *Hylaeosaurus*.

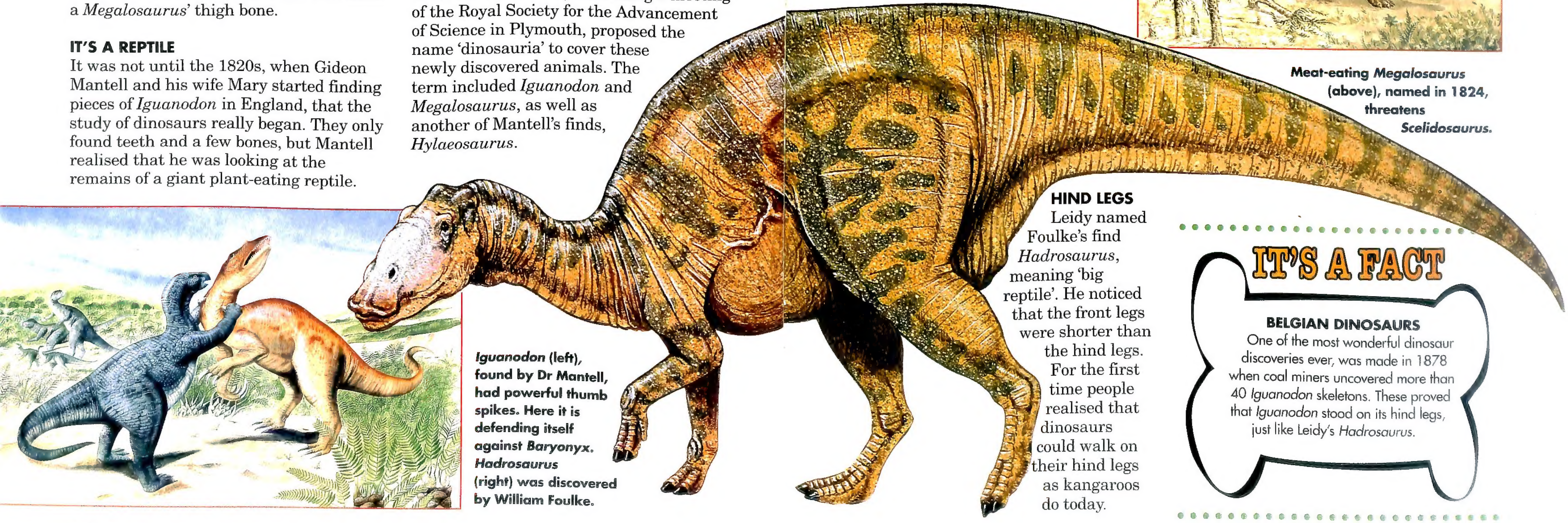
### THE FIRST AMERICAN FINDS

Across the Atlantic, back in 1802, a Massachusetts farm boy, called Pliny Moody, found fossilized dinosaur footprints. He thought they were the footprints of giant birds.

### DINOSAUR NEWS SPREADS

News of the British discoveries spread to America. In the mid-1850s a palaeontologist from Philadelphia, named Joseph Leidy, identified fossils found in Montana as dinosaur teeth. Then, in 1858, William Parker Foulke found a collection of dinosaur bones in a clay pit in New Jersey. He sent the fossils to Joseph Leidy.

**Meat-eating *Megalosaurus* (above), named in 1824, threatens *Scelidosaurus*.**



***Iguanodon* (left), found by Dr Mantell, had powerful thumb spikes. Here it is defending itself against *Baryonyx*. *Hadrosaurus* (right) was discovered by William Foulke.**

### HIND LEGS

Leidy named Foulke's find *Hadrosaurus*, meaning 'big reptile'. He noticed that the front legs were shorter than the hind legs. For the first time people realised that dinosaurs could walk on their hind legs as kangaroos do today.

## IT'S A FACT

### BELGIAN DINOSAURS

One of the most wonderful dinosaur discoveries ever, was made in 1878 when coal miners uncovered more than 40 *Iguanodon* skeletons. These proved that *Iguanodon* stood on its hind legs, just like Leidy's *Hadrosaurus*.

This huge *Barosaurus* skeleton, in the American Museum of Natural History, was excavated by Earl Douglass between 1912 and 1914.

## ANCIENT ANIMALS OF THE NEW WORLD

For the rest of the 19th century and the beginning of the 20th, North America was the focus of dinosaur finds. The opening up of the wild west meant that many people spread out into the newly explored continent. Railway engineers followed, blasting through rocks and exposing fossils. Stories came back to the east coast about the fossil bones that were being uncovered. Scientists from the east coast went out to investigate.

## TWO RIVALS

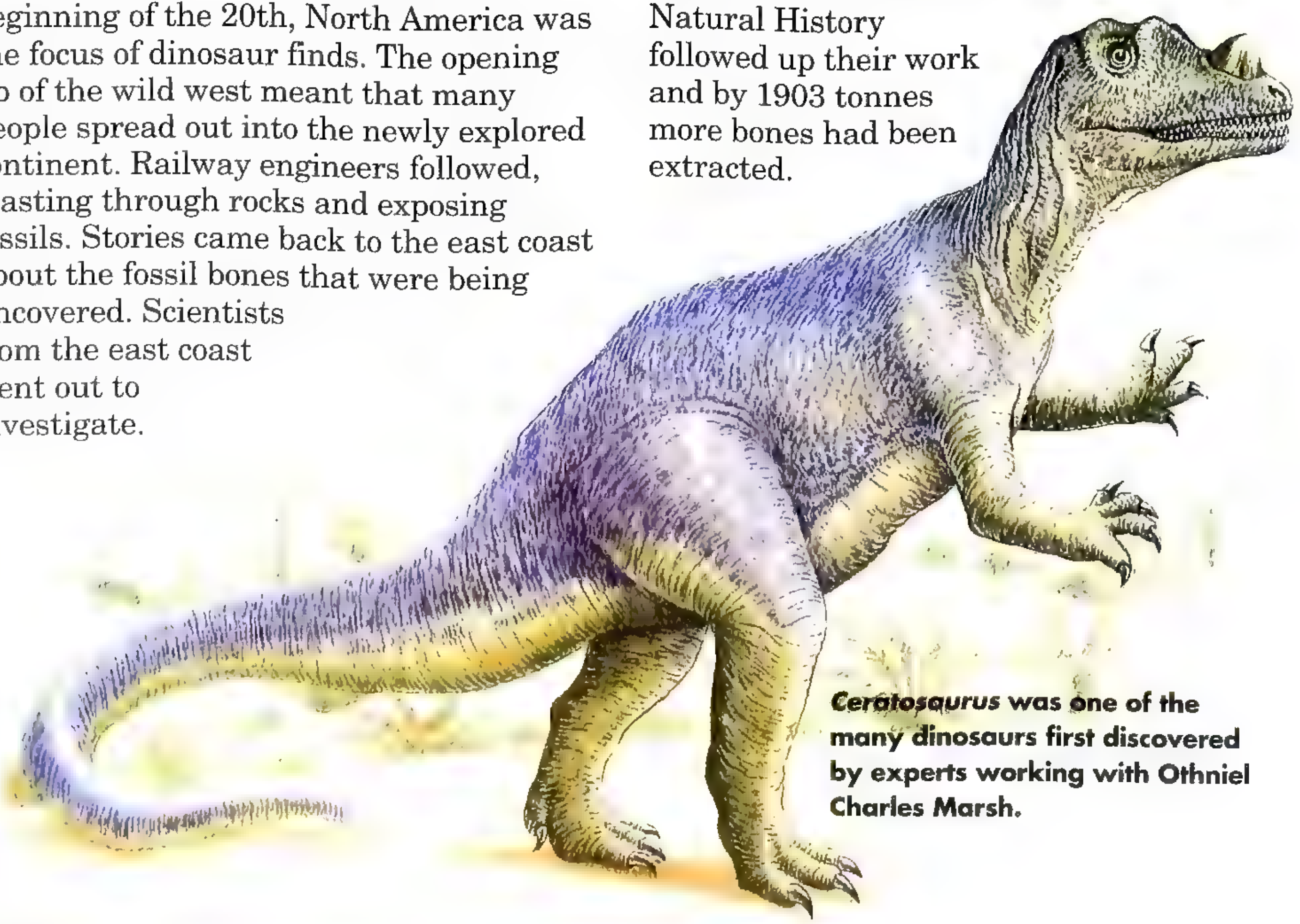
The two most famous American palaeontologists from this time were Othniel Charles Marsh and Edward Drinker Cope. From the 1870s onwards their rival teams continually sabotaged each other's operations, bribed each other's workers, raided each other's collections and, on occasions, came to blows!

## MANY NEW FINDS

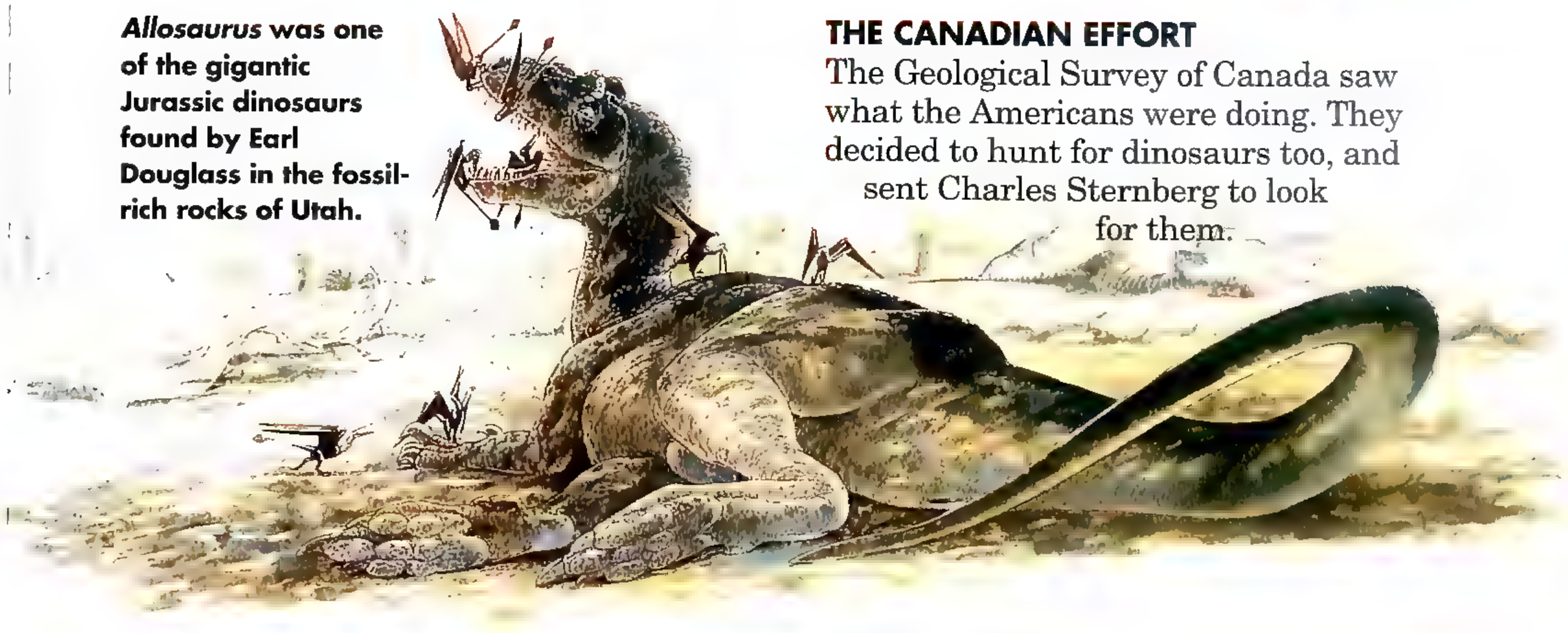
The whole sorry affair become known as the 'Bone Wars'. The plus side was that after about 20 years of this 'war' Marsh and Cope had, between them, found 136 new kinds of dinosaur.

## BUILDING ON SUCCESS

Most of these discoveries were made in the Morrison Formation, which runs along the foothills of the Rocky Mountains. They were mainly of Late Jurassic dinosaurs. The American Museum of Natural History followed up their work and by 1903 tonnes more bones had been extracted.



*Ceratosaurus* was one of the many dinosaurs first discovered by experts working with Othniel Charles Marsh.



*Allosaurus* was one of the gigantic Jurassic dinosaurs found by Earl Douglass in the fossil-rich rocks of Utah.

## UTAH FINDS

In 1909 Earl Douglass, from the Carnegie Museum in Pittsburgh, began excavating in Utah. He sent 350 tonnes of bones back to the museum. This site is now the Dinosaur National Monument.

## RICH PICKINGS

The dinosaur-rich rocks of the USA continue northwards into Canada. Early in the 20th century scientists were searching for dinosaurs in Canada, too. The first expeditions were made by the American Museum of Natural History and were led by Barnum Brown. In 1910 this famous fossil-hunter sailed along the Red Deer River in Alberta. He collected many Cretaceous dinosaurs from the walls of the gorge as he went.

## THE CANADIAN EFFORT

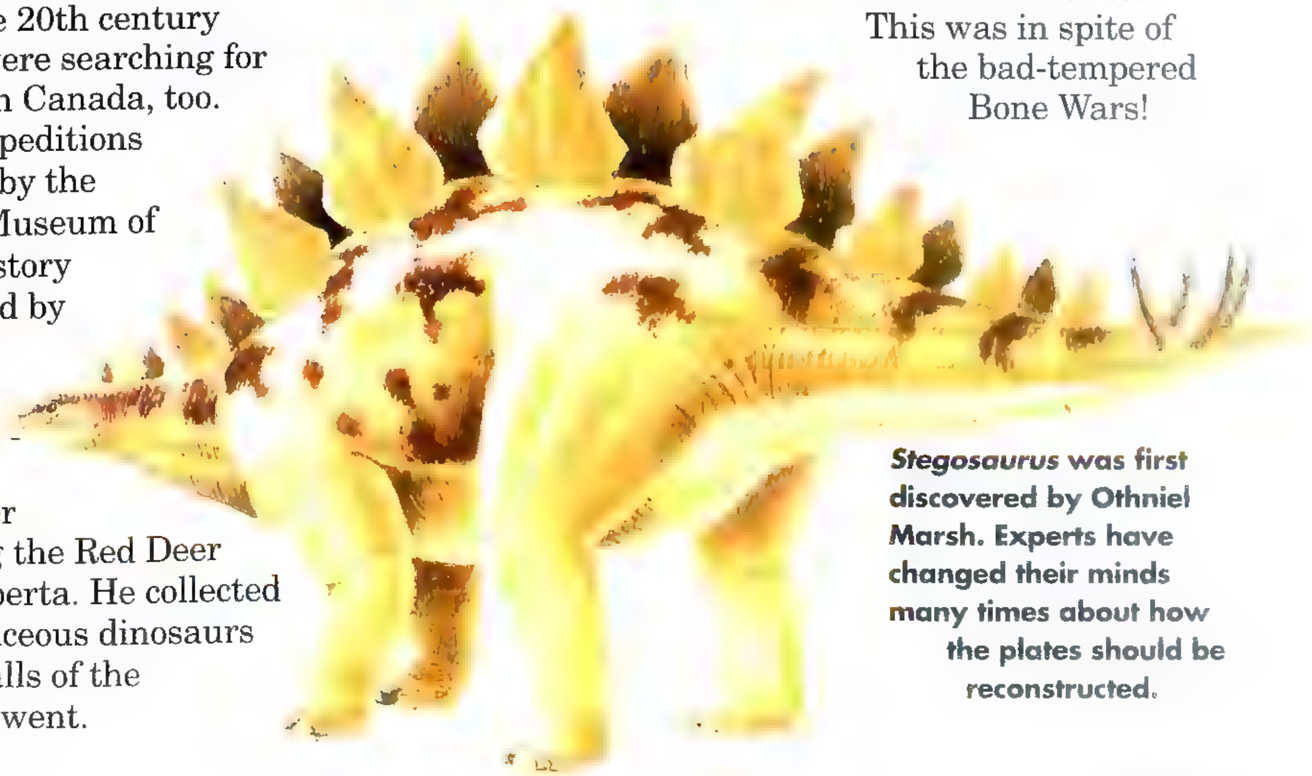
The Geological Survey of Canada saw what the Americans were doing. They decided to hunt for dinosaurs too, and sent Charles Sternberg to look for them.

## FAMILY FINDS

Charles Sternberg had learnt his fossil-hunting skills from Cope. He passed them on to his three sons. Between them they found and named many new dinosaurs.

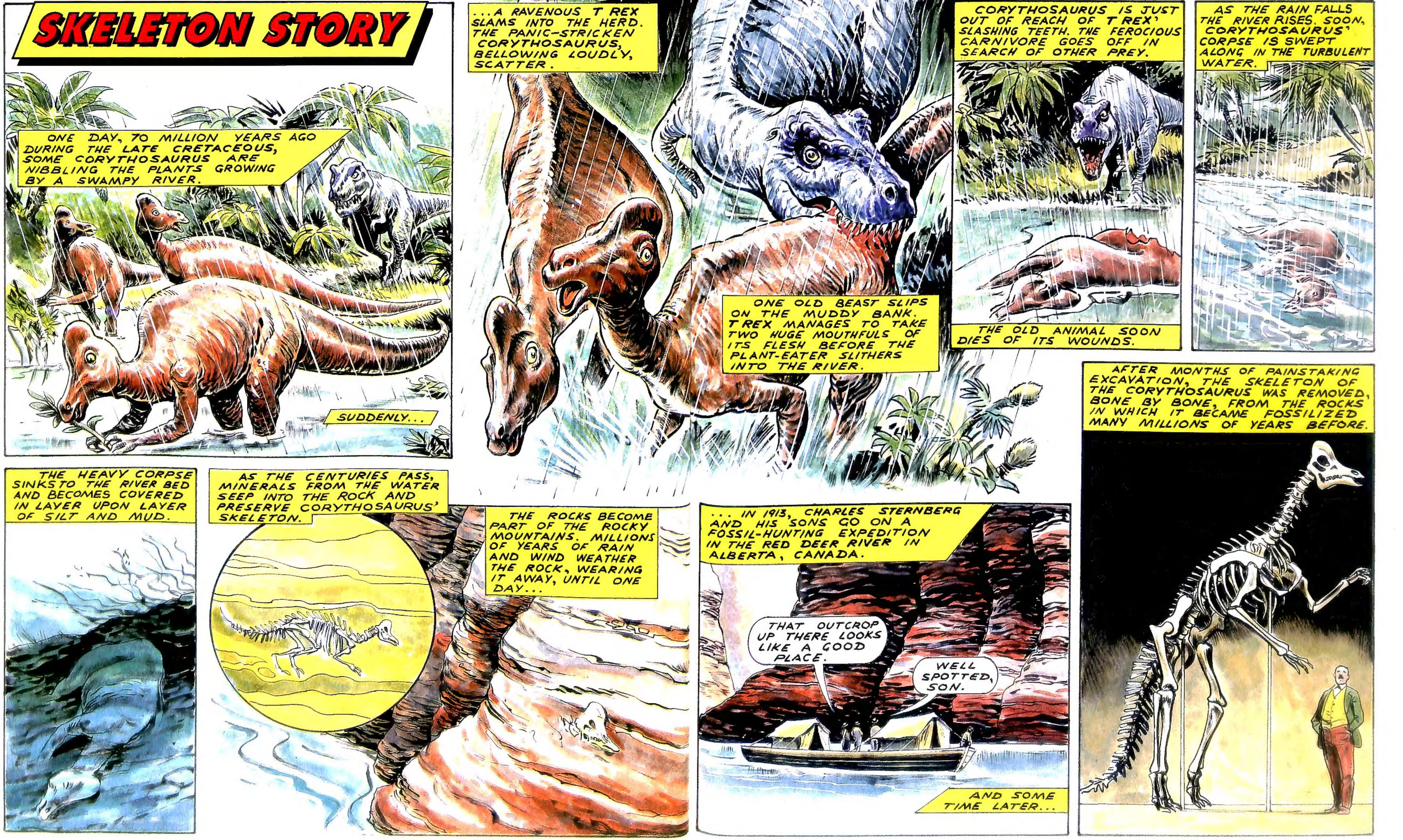
## SUCCESSFUL HUNT

By the early part of the 20th century we had a much better understanding of dinosaurs because of the great North American dinosaur hunts. This was in spite of the bad-tempered Bone Wars!



*Stegosaurus* was first discovered by Othniel Marsh. Experts have changed their minds many times about how the plates should be reconstructed.

# SKELETON STORY


ONE DAY, 70 MILLION YEARS AGO DURING THE LATE CRETACEOUS, SOME CORYTHOSAURUS ARE NIBBLING THE PLANTS GROWING BY A SWAMPY RIVER.
SUDDENLY...
...A RAVENOUS T REX SLAMS INTO THE HERD. THE PANIC-STRICKEN CORYTHOSAURUS, BELLOWING LOUDLY, SCATTER.
ONE OLD BEAST SLIPS ON THE MUDDY BANK. T REX MANAGES TO TAKE TWO HUGE MOUTHFULS OF ITS FLESH BEFORE THE PLANT-EATER SLITHERS INTO THE RIVER.
CORYTHOSAURUS IS JUST OUT OF REACH OF T REX' SLASHING TEETH. THE FEROCIOUS CARNIVORE GOES OFF IN SEARCH OF OTHER PREY.
THE OLD ANIMAL SOON DIES OF ITS WOUNDS.
AS THE RAIN FALLS THE RIVER RISES. SOON, CORYTHOSAURUS' CORPSE IS SWEPT ALONG IN THE TURBULENT WATER.
THE HEAVY CORPSE SINKS TO THE RIVER BED AND BECOMES COVERED IN LAYER UPON LAYER OF SILT AND MUD.
AS THE CENTURIES PASS, MINERALS FROM THE WATER SEEP INTO THE ROCK AND PRESERVE CORYTHOSAURUS' SKELETON.
THE ROCKS BECOME PART OF THE ROCKY MOUNTAINS. MILLIONS OF YEARS OF RAIN AND WIND WEATHER THE ROCK, WEARING IT AWAY, UNTIL ONE DAY...
... IN 1913, CHARLES STERNBERG AND HIS SONS GO ON A FOSSIL-HUNTING EXPEDITION IN THE RED DEER RIVER IN ALBERTA, CANADA.
THAT OUTCROP UP THERE LOOKS LIKE A GOOD PLACE.
WELL SPOTTED, SON.
AND SOME TIME LATER...
AFTER MONTHS OF PAINSTAKING EXCAVATION, THE SKELETON OF THE CORYTHOSAURUS WAS REMOVED, BONE BY BONE, FROM THE ROCKS IN WHICH IT BECAME FOSSILIZED MANY MILLIONS OF YEARS BEFORE.

Improve and test your knowledge with...

# FACT FILE

**Dimetrodon** holds all the answers. See how you score in the quiz.

### Blown to pieces

Dinosaur experts today take months and years to excavate fossils. They are very careful not to damage any of the fragile bones. When Solomon Ellsworth found a dinosaur in 1818 it was after blasting a huge hole in the ground to make a well. Not surprisingly, the skeleton was blown to pieces! A few bones were saved and they are among the first dinosaur bones found in North America that can still be seen today.

### Big name babies

In 1993 skeletons of baby sauropods were found in Thailand. They were 2m long and 50cm high. The name they have been given is Phuwiangosaurus.

**1** The bone found by Robert Plot in 1677 was:

- a) *Iguanodon's* thumb spike
- b) *Megalosaurus'* thigh bone
- c) *Styracosaurus'* skull

**2** *Supersaurus* was:

- a) a plant-eating dinosaur
- b) a prehistoric crocodile
- c) a giant bird

**3** When did the dinosaur *Gilmoreosaurus* live?

- a) in the Early Cretaceous Period
- b) in the Early Permian Period
- c) in the Late Cretaceous Period

**4** How were *Styracosaurus'* toes arranged?

- a) fused into a stump
- b) separately
- c) it didn't have toes

**5** How long was *Liopleurodon's* head?

- a) less than 1m long
- b) more than 4m long
- c) about 2m long

**6** What is the Morrison Formation?

- a) a dinosaur dance team
- b) a museum in Canada
- c) rocks in the Rocky Mountains

**7** What was odd about *Cacops'* ears ?

- a) they were behind its eyes
- b) they stood out on stalks
- c) they were on its knees

**8** How could *Corythosaurus* have made a calling noise?

- a) by using its teeth
- b) by using its crest
- c) by using its tail

**9** Who first discovered fossil remains of *Allosaurus*?

- a) Charles Sternberg
- b) Pliny Moody
- c) Earl Douglass

**10** What sort of dinosaur is *Lambeosaurus*?

- a) a duckfoot
- b) a duckbill
- c) a duckleg

### Egg-citement!

When Roy Chapman Andrews returned from Mongolia after discovering the first dinosaur eggs, he gave a lecture. Over 4,000 people fought to get one of the 1,400 seats to hear him.

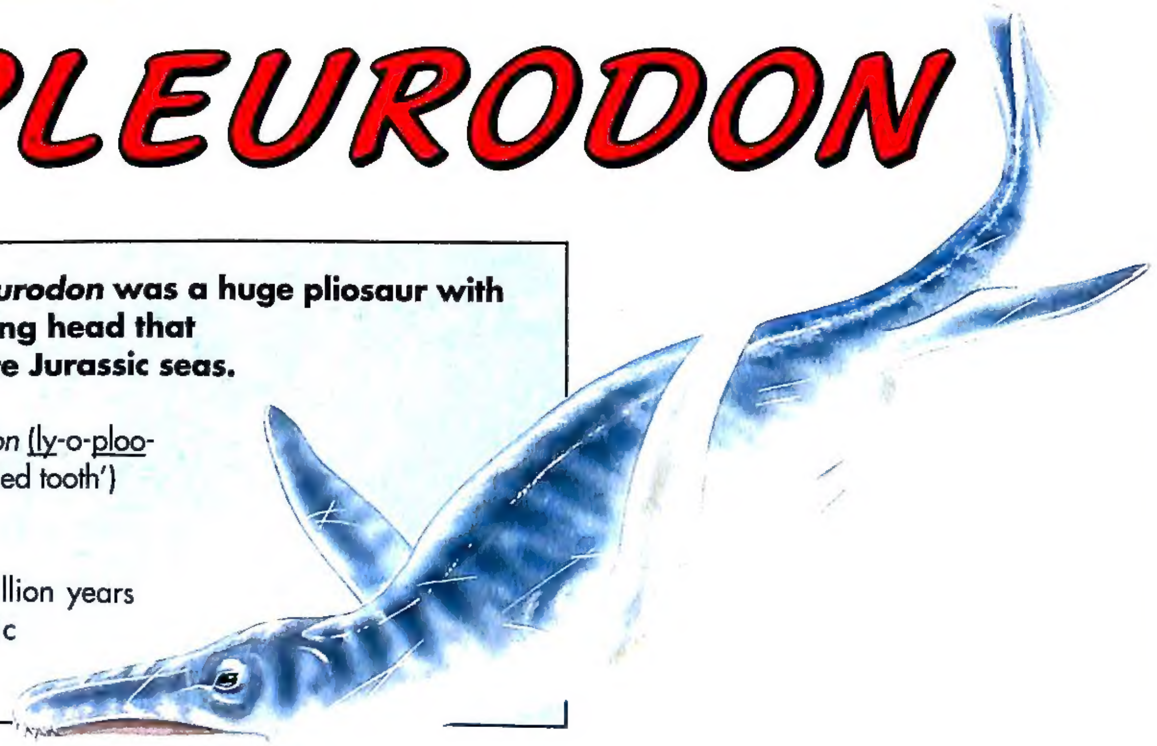
### Bony lump

Achelousaurus was a ceratopian with a bony lump over its nose. It also had a pair of horns at the top of its frill.

Answers to the questions on inside back cover

**HOW TO DRAW**

# LIOPLEURODON

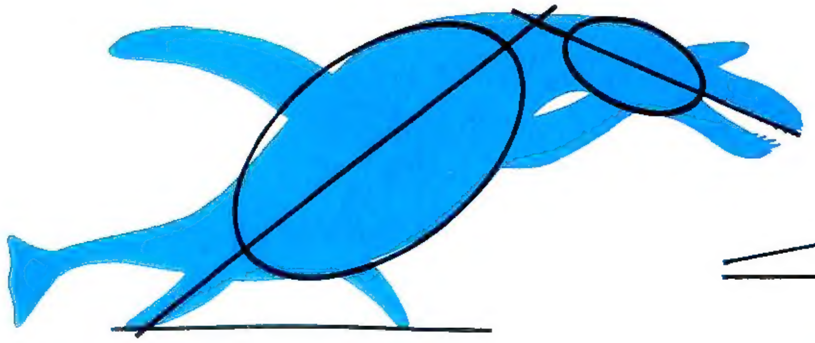


**Fact box**

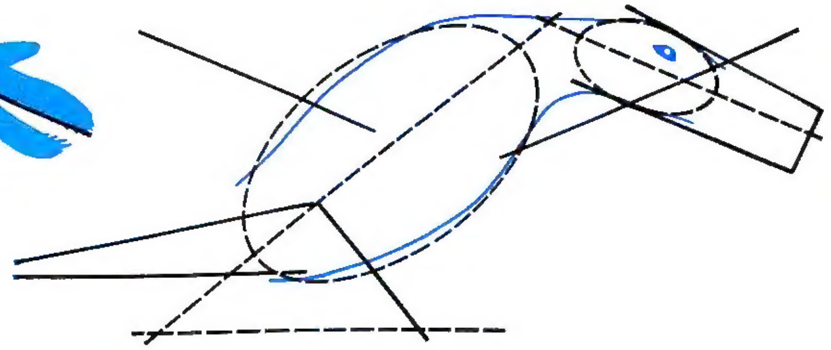
***Liopleurodon* was a huge pliosaur with a 2m-long head that roamed Late Jurassic seas.**

- ● **NAME:** *Liopleurodon* (ly-o-ploo-ro-don) means 'smooth-sided tooth')
- ● **GROUP:** reptile
- ● **SIZE:** 12m long
- ● **LIVED:** about 140 million years ago in the Late Jurassic Period in Europe

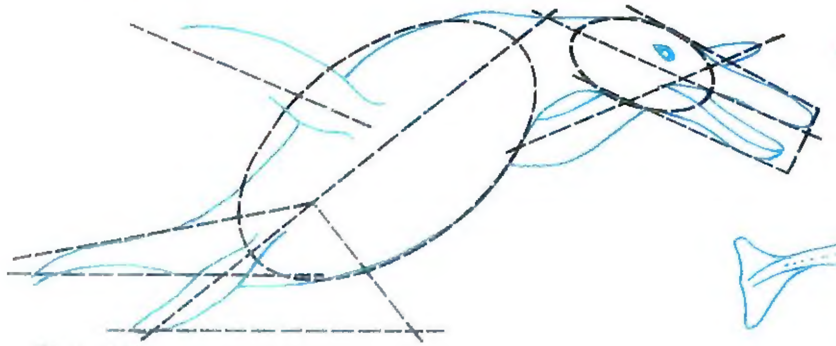
**1** First draw three straight pencil lines to make *Liopleurodon*'s basic shape. Then add a large oval for the main part of its body and a smaller one for the head.



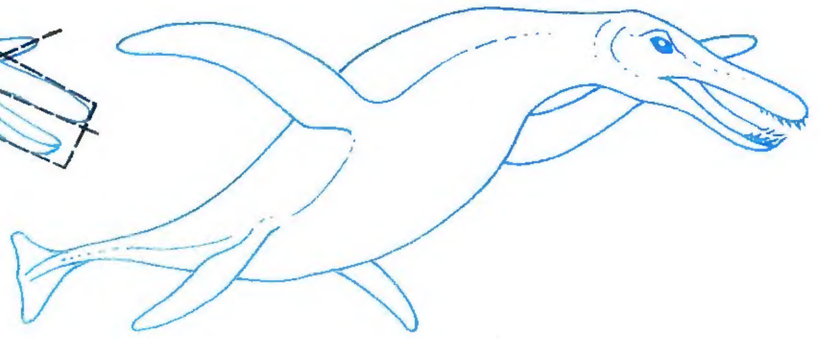
**2** Now draw in more detailed curved lines for the body and head. Lightly pencil in some guidelines for the flippers and *Liopleurodon*'s long jaws.



**3** Draw the open jaws and three of the four powerful flippers. Keep looking at your pencil guidelines to help you get the angles of the body parts exactly right.



**4** Now finish your prehistoric sea monster. Add the second back flipper to the body and sharp teeth to the head. Finally colour your pliosaur, in any way you like.



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## COMING IN PART 103 OF

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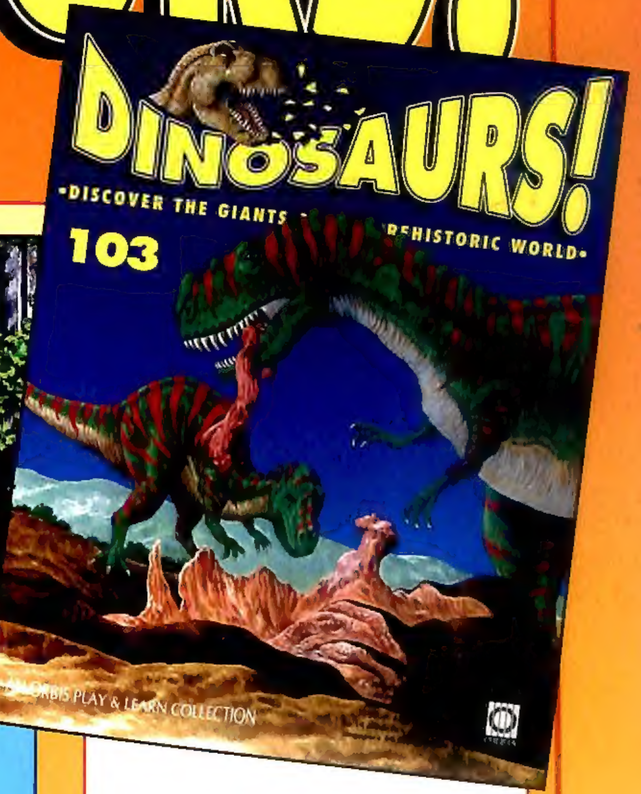

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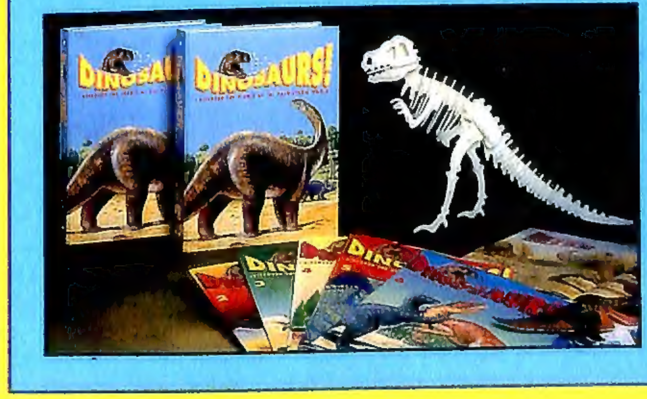

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## PLUS

### COMING IN PART 104

**a complete index for all your copies of DINOSAURS! Plus 3-D gallery, a dino quiz and a useful glossary.**

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**ANSWERS TO FACT FILE QUESTIONS:** 1.b 2.a 3.c 4.b 5.c 6.c 7.a 8.b 9.c 10.b

**Dr David Norman of Cambridge University answers your dinosaur questions**

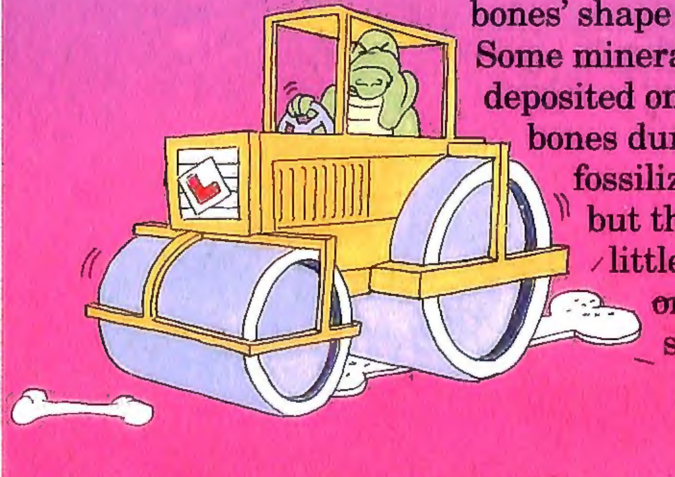
# ASK THE EXPERT

## Could all pterosaurs fly?

Some experts have wondered whether anything as big as a *Quetzalcoatlus* really could fly. However, the pterosaur remains found so far indicate that all pterosaurs were specially designed for flying, just like bats are today. The wing membranes were attached to the legs as well as the arms, so a flightless pterosaur would have been helpless on land.

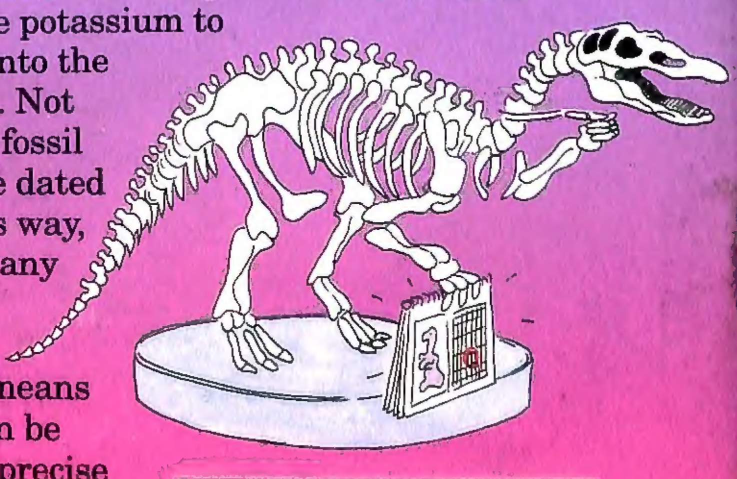
## Do dinosaur bones change size at all when they become fossils?

No, not significantly. It does depend on the degree of compression or distortion of the sediments in which the fossil bones were buried because this may change the bones' shape a little. Some minerals get deposited on the bones during fossilization, but this has little effect on the size.



## How do we know how long ago dinosaurs lived?

Dating of the rocks in which dinosaur fossils are found is done by a technique called radioactive dating. One of the most common types of radioactive dating is the potassium/argon method. This relies on the fact that the radioactive element potassium decays, or breaks down, at a known rate to produce a gas called argon. Experts take a sample of volcanic rock, which will contain potassium, that was deposited at the same time as the fossil-bearing rock they want to date. The amounts of potassium and argon are measured and it can then be calculated how long it must have taken for the potassium to turn into the argon. Not every fossil can be dated in this way, but many have been. This means we can be quite precise about the age of many of our dinosaur discoveries.



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